MAY 1971

# VARIAN 620/L

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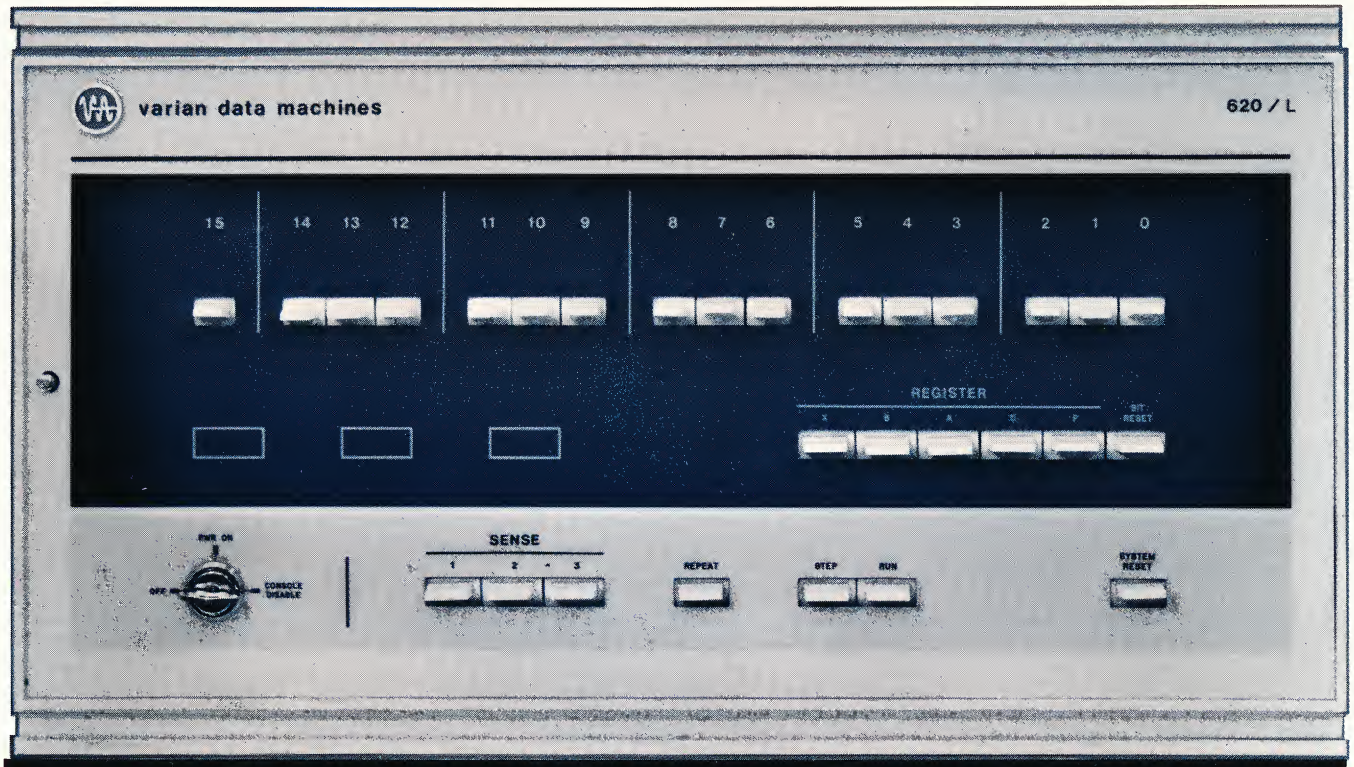





The Varian 620/L is a dramatic new computer, based on design concepts that have significantly changed the price/performance ratio for computers in its class.

The Varian 620/L represents, at the same time, the next logical step in the evolving Varian 620 computer family. Unlike most new computers, the Varian 620/L is not a minimal mainframe, lacking in essential auxiliary equipment and services. Peripherals, software, application programs, developed for earlier Varian 620 models, are off-the-shelf items, ready for immediate use.

Couple these facts with the support provided by Varian's worldwide field service organization, and the Varian 620/L becomes the most valuable computer for the dollar in the minicomputer marketplace.

## The Larger-System Computer

Applications for the Varian 620/L cover the complete computer spectrum: instrumentation systems, data acquisition systems, time-share networks, scientific and commercial computing.

Within each of these application areas, the Varian 620/L occupies a special position. Up till now, the drive to develop minimum-priced minicomputers has placed the emphasis on minimum systems: 4K of memory, spares peripherals, a limited programming capability.

For many of the most important applications, however, a minimum system is not enough. The majority require 8K of memory or more, an expanded input/output capability, efficient programming based on an adequate instruction set and an array of programming tools.

The Varian 620/L has been specifically designed for the larger-system user. It is at this level that the new computer comes into its own.

## Efficient Programming

Over one hundred Varian 620/L commands can be used by the programmer to write fast and efficient programs that occupy a minimum of core storage.

Users of the Varian 620/L can also take immediate advantage of the dozens of software packages and application programs that have been developed for the Varian 620 series. Standard packages include FORTRAN IV, BASIC, DAS assembly language, RPG IV, MOS Master Operating System, AID II and MAINTAIN.

A number of special-purpose software packages are also available, each designed to increase the effectiveness of a computer system and reduce the start up time required to put the system in full operation.

## Variety of Peripherals

The industry's most complete complement of peripherals and I/O interfaces makes the design of a highly cost/effective Varian 620/L system a simple task of selection and specification.

Interfaces are available for every type of standard peripheral device. In addition, special-purpose interfaces are available, such as a control unit for interfacing between the Varian 620/L and an IBM 360 computer.

## Worldwide Service

Varian maintains a worldwide field service organization to assure continuous, trouble-free operation of Varian 620/L systems. Service contracts cover both preventative maintenance on a scheduled basis and emergency repair.

A Varian users' organization, VOICE, disseminates information on new software and hardware developments and serves as a clearinghouse for user programs.

## Economy in Dollars

The Varian 620/L offers more capabilities for fewer dollars than any comparable computer system.

Key to this economy are new packaging concepts and a new high-performance, low-cost memory module developed by Varian. The new memory has resulted in significant savings, even in the case of a basic 4K system. But as the system expands, the savings multiply. Large-memory systems are no longer a luxury.

THE BIGGER THE MEMORY, THE LARGER THE SAVINGS.

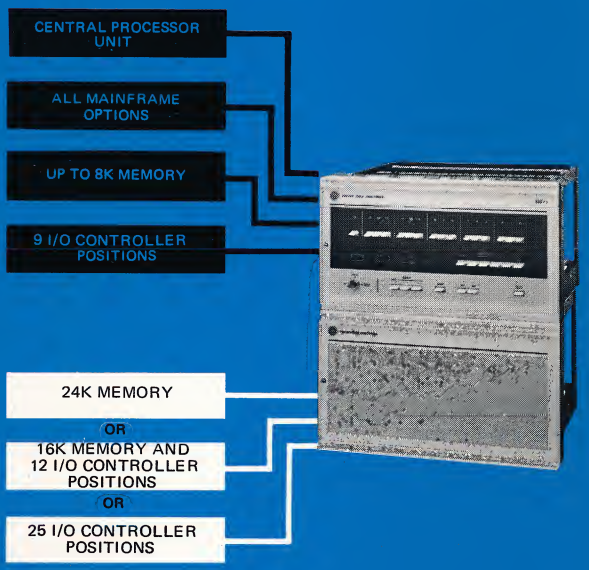
An expanded memory provides important benefits. Complex programs can be kept in core storage without restricting the volume of data that can be processed. There is more room for look-up tables, constants, and other programming aids. The combination of an expanded memory and the standard DMA (direct memory access) channel allows the user to process large batches of information, efficiently and fast.

## Economy in Space

The new Varian packaging techniques and memory modules also allow more computer capabilities to be contained in less space.

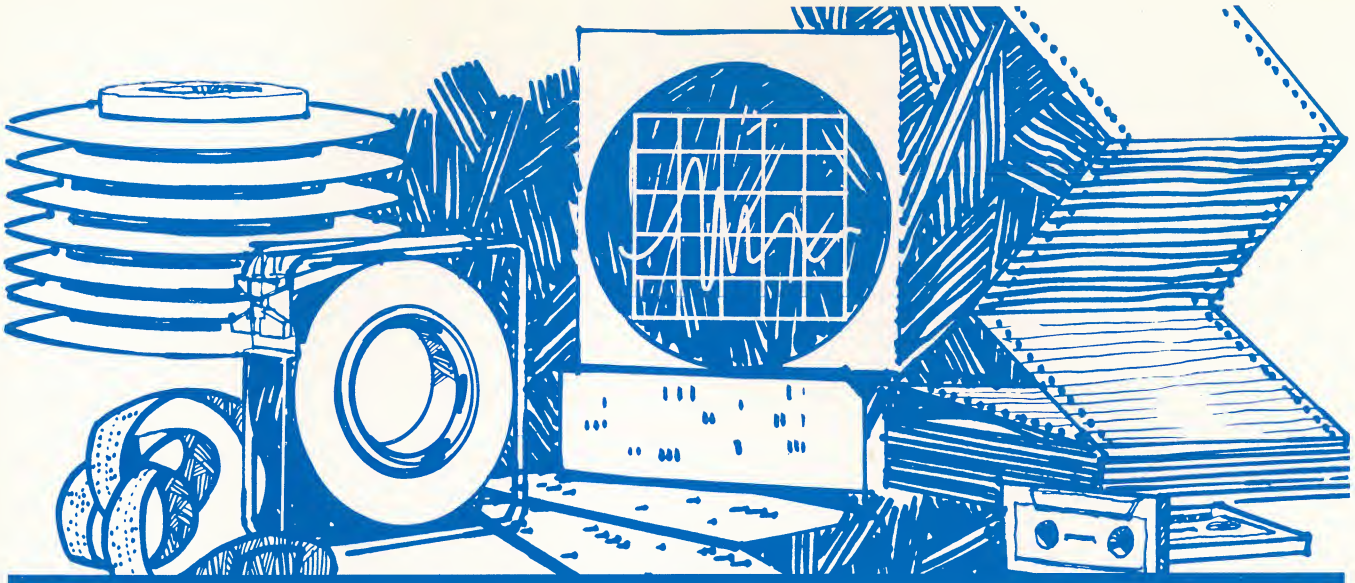
The main-frame enclosure, for example, can now accommodate a complete system, including all main-frame options, up to 8K of memory, and interface controllers for up to 9 peripheral devices. Full expansion up to 32K of memory requires only one additional enclosure, the same size as the main-frame. Three versions of the auxillary chassis are available for additional memory, peripheral controllers, or a combination of both.

A single power supply, provided with the basic system, can accommodate up to 32K of memory, a number of I/O controllers, and all main-frame options.




A 32K SYSTEM, IN ONLY 21 INCHES OF RACK SPACE.

# SOFTWARE





**ASSEMBLERS**
Varian 620/L DAS Assemblers are invaluable programming aids. Their function is to translate symbolic source language instructions into absolute or relocatable object programs. The DAS 4A Assembler is designed to operate with a minimum 4K and teletype system. The DAS 8A is for systems with a larger memory and a greater variety of peripherals. DAS MR operates under control of the Varian Master Operating System (MOS) and provides macro-programming capability.

**FORTRAN IV**
The Varian FORTRAN IV programming system is available both as part of the Master Operating System (MOS) and in a stand-alone version that can operate on a Varian 620/L with only 8K of memory. The FORTRAN IV language is fully compatible with and encompasses the ANSI Standard FORTRAN.

**BASIC**
The Varian BASIC programming system provides an easy-to-use, conversational programming language for a wide variety of business and scientific applications. The simplicity of the system permits an inexperienced operator to perform useful programming with just a few hours of training. The computer responds to all commands entered by the user; if the operator makes an error, diagnostics report the type of error, and corrections can be made immediately.

**MASTER OPERATING SYSTEM**
The Varian Master Operating System (MOS) is a completely integrated software package for automated batch processing on larger Varian 620/L systems. The system package includes System Prep, EXEC, Resident Monitor, System Loader, Input/Output Control System, DAS Assembler, FORTRAN IV, AID II, MAINTAIN, EDIT, and Library.

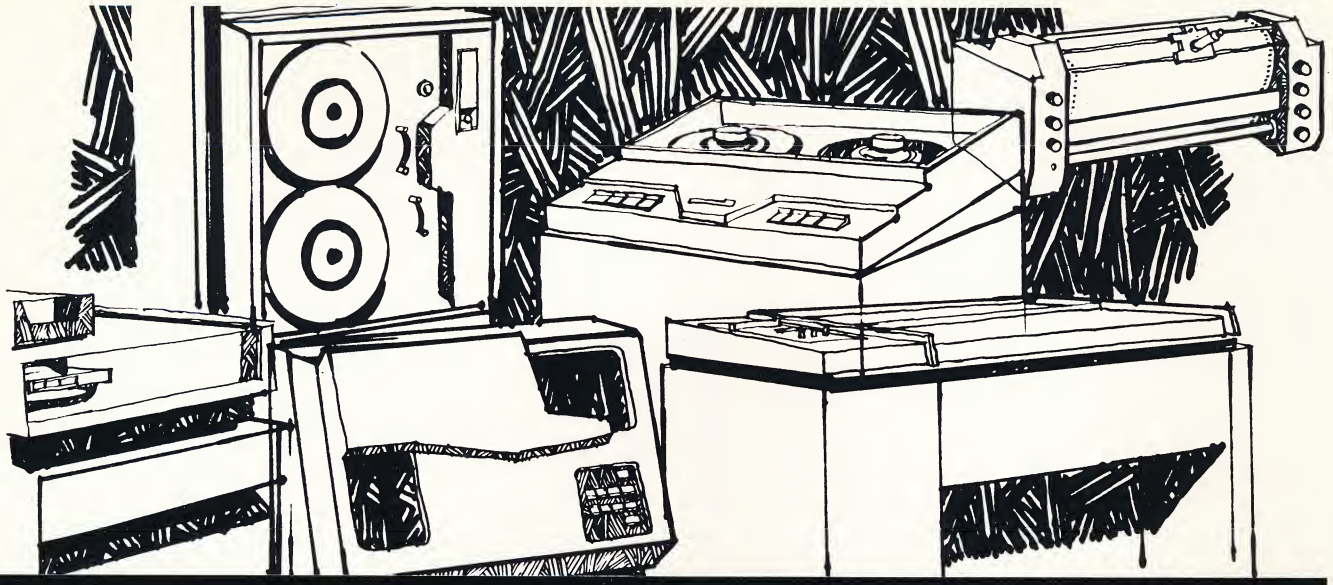
**RPG IV**
The RPG IV (Report Program Generator) program is a flexible tool for writing programs that produce reports, financial statements, sales records, and other commercial documents and listings. Programs written in the RPG IV format can be expressed much more concisely than comparable programs in COBOL, often by a factor of four to one. Sequence checking, input auditing, report writing, and other processing logic are built into the language.

**MATH LIBRARY**
A comprehensive math library is provided which includes the most commonly used subroutines. The library includes routines for logarithmic, exponential, trignometric functions, and for fixed and floating-point arithmetic.

**AID II**
AID II is a group of useful diagnostic and utility routines that provide on-line debugging of programs. AID II includes routines to correct memory, establish breakpoints, search memory, and print memory. Also included is a comprehensive binary paper tape handler that is particularly useful in preserving programs modified on the computer.

**MAINTAIN II**
The MAINTAIN software package consists of diagnostic programs used in the off-line mode to check instructions, memory, options, and peripherals. Preliminary tests provide a rapid overview of total system operations. Separate comprehensive tests can then be used to isolate malfunctions within specific hardware segments, such as the CPU, memory, or I/O device.

# PERIPHERALS



Peripheral systems for the Varian 620/L have been field tested in hundreds of installations and have been selected to provide an optimum combination of economy and high performance.

FIXED-HEAD DISC — Low-cost storage, with capacity of 30K, 61K, or 123K words; 17 ms access time; 73.3K word transfer rate; 1 head per track; 16, 32, or 64 tracks.

MOVING-HEAD DISC — Capacities of 585K, 3.6 million and 7.25 million words; 12.5 ms and 20 ms access time, 42K and 80K word transfer rate.

DRUM MEMORY — Capacity of 30K, 61K, 123K, 491K, or 983K; 8.7 ms access time; 106K word transfer rate; 1 head per track; 16, 32, 64, 128, 256, or 512 tracks.

MAGNETIC TAPE — 9-track or 7-track, with multiple-transport systems connected in party-line configuration, densities of 200, 556, and 800 bpi and speed of 25 ips.

TELETYPES — Model ASR 33, ASR 35, or KSR 35 units.

HIGH-SPEED PAPER TAPE — Punch rates up to 75 characters per second and read rates up to 300 characters per second.

CARD READER — Reading speed of 1,000 or 300 cards per minute.

CARD PUNCH — Punching speed of 35, 200 or 300 cards per minute.

LINE PRINTER — Up to 1100 lines per minute, up to 132 characters per line, buffered, ASCII code, 64 alphanumeric characters and symbols.

DIGITAL PLOTTER — Records at rate of 300 increments per second, 0.01-inch increments, 8-vector plotting format, 12-inch paper width.

ELECTROSTATIC PLOTTER — Statos 21 Printer/Plotter; produces graphic displays at data rates up to 800 KHz; can print alphanumeric information at rates up to 5,000 lines per minute.

ANALOG CONVERTERS — Multiplex and convert up to 256 analog inputs, or up to 64 analog outputs. ADC's convert to 13-bit binary; DAC's operate on 10, 12, or 14-bit data.

CRT DISPLAYS — 5-inch square display, drives XY axes by converting 12-bit data at 100 kHz rate, 0.1% accuracy. Also 5-inch and 11-inch displays that convert 10-bit data at 100 kHz rate.

RELAY INTERFACES — 16 contact inputs and mercury-wetted contact outputs; 0.5 or 3 ampere-current; 200 V or 400 V.

GENERAL PURPOSE INTERFACES — Buffer Interlace Controller; Dual Access Buffer Controller; Buffered I/O Controller; Digital I/O Controller.

DATA SET COUPLERS — Interface with Type 103, 201, and 301 Modems, single and double buffered; transmission rates up to 4800 baud; controller available for Automatic Call Unit.

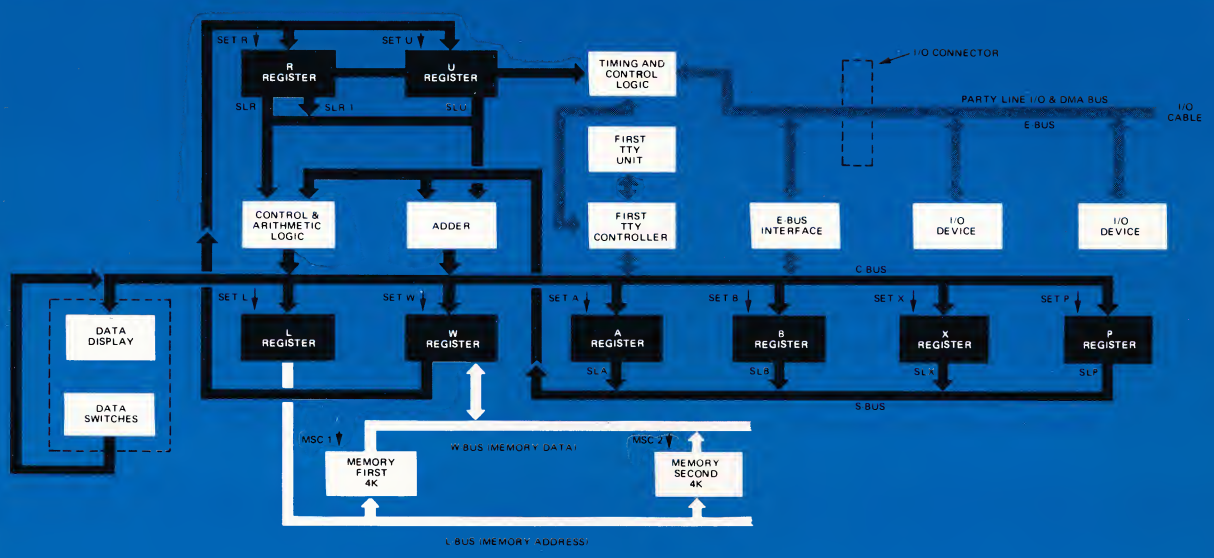
COMMUNICATIONS CONTROLLER — Multiplexes, controls and provides data interface for up to 64 data sets; synchronous and asynchronous; modular line controllers for RS 232B, CCITT, discrete, and relay communication systems.

# VARIAN 620/L INSTRUCTION LIST

| Type | Mnemonic | Description | Cycles |
|---|---|---|---|
| Load | LDA | Load A Register | 2 |
| | LDB | Load B Register | 2 |
| | LDX | Load X Register | 2 |
| Store | STA | Store A Register | 2 |
| | STB | Store B Register | 2 |
| | STX | Store X Register | 2 |
| Arith-metic | ADD | Add to A Register | 2 |
| | SUB | Subtract from A Register | 2 |
| | INR | Increment and Replace | 3 |
| | MUL* | Multiply B Register, Double Length | 10 |
| | DIV* | Divide AB Register, Double Length | 10-14 |
| Logical | ERA | Exclusive OR to A Register | 2 |
| | ORA | Inclusive OR to A Register | 2 |
| | ANA | And to A Register | 2 |
| Jump | JMP | Jump UNCONDITIONALLY | 2 |
| | JOF | Jump if Overflow SET | 2 |
| | JAN | Jump if Register NEGATIVE | 2 |
| | JAZ | Jump if A Register ZERO | 2 |
| | JAP | Jump if Register POSITIVE | 2 |
| | JSS1 | Jump if Sense Switch 1 is SET | 2 |
| | JSS2 | Jump if Sense Switch 2 is SET | 2 |
| | JSS3 | Jump if Sense Switch 3 is SET | 2 |
| | JXZ | Jump X Register ZERO | 2 |
| | JBZ | Jump B Register ZERO | 2 |
| Jump and Mark | JMPM | Jump UNCONDITIONALLY and Mark | 2 |
| | JOFM | Jump Overflow SET and Mark | 2-3 |
| | JANM | Jump A Register Negative and Mark | 2-3 |
| | JAZM | Jump A Register ZERO | 2-3 |
| | JAPM | Jump A Register Positive and Mark | 2-3 |
| | JS1M | Jump Sense Switch 1 SET and Mark | 2-3 |
| | JS2M | Jump Sense Switch 2 SET and Mark | 2-3 |
| | JS3M | Jump Sense Switch 3 SET and Mark | 2-3 |
| | JXZM | Jump X Register ZERO and Mark | 2-3 |
| | JBZM | Jump B Register ZERO and Mark | 2-3 |
| Exe-cute | XEC | UNCONDITIONAL Execute | 2 |
| | XOF | Execute Overflow SET | 2 |
| | XAN | Execute A Register NEGATIVE | 2 |
| | XAZ | Execute A Register ZERO | 2 |
| | XAP | Execute A Register POSITIVE | 2 |
| | XS1 | Execute Sense Switch 1 SET | 2 |
| | XS2 | Execute Sense Switch 2 SET | 2 |
| | XS3 | Execute Sense Switch 3 SET | 2 |
| | XXZ | Execute X Register ZERO | 2 |
| | XBZ | Execute B Register ZERO | 2 |
| Immediate | | | |
| | LDA1 | Load A Register Immediate | 2 |
| | LDB1 | Load B Register Immediate | 2 |
| | LDX1 | Load X Register Immediate | 2 |
| | STA1 | Store A Register Immediate | 2 |
| | STB1 | Store B Register Immediate | 2 |
| | STX1 | Store X Register Immediate | 2 |
| | ADD1 | Add to A Register Immediate | 2 |
| | SUB1 | Subtract from A Register Immediate | 2 |
| | MUL1* | Multiply B Register Immediate Double Length | 10 |
| | DIV1* | Divide AB Register Immediate Double Length | 10-14 |
| Immediate (Cont) | | | |
| | INR1 | Increment and Replace Immediate | 3 |
| | ERA1 | Exclusive OR to A Register Immediate | 2 |
| | ORA1 | Inclusive OR to A Register Immediate | 2 |
| | ANA1 | And to A Register Immediate | 2 |
| Input/ Output | EXC | External Control Function | 1 |
| | CIA | Clear and Input to A Register | 2 |
| | CIB | Clear and Input to B Register | 2 |
| | CIAB | Clear and Input to A and B Registers | 2 |
| | INA | Input to A Register | 2 |
| | INB | Input to B Register | 2 |
| | INAB | Input to A and B Registers | 2 |
| | IME | Input to Memory | 3 |
| | OAR | Output A Register | 2 |
| | OBR | Output B Register | 2 |
| | OAB | Output OR of A and B Registers | 2 |
| | OME | Output from Memory | 3 |
| | SEN | Sense Input/Output Lines | 2.25 |
| Register Change | | | |
| | IAR | Increment A Register | 1 |
| | DAR | Decrement A Register | 1 |
| | IBR | Increment B Register | 1 |
| | DBR | Decrement B Register | 1 |
| | IXR | Increment X Register | 1 |
| | DXR | Decrement X Register | 1 |
| | CPA | Complement A Register | 1 |
| | CPB | Complement B Register | 1 |
| | CPX | Complement X Register | 1 |
| | TAB | Transfer AR to B Register | 1 |
| | TBA | Transfer BR to A Register | 1 |
| | TAX | Transfer AR to X Register | 1 |
| | TBX | Transfer BR to X Register | 1 |
| | TXA | Transfer XR to A Register | 1 |
| | TXB | Transfer XR to B Register | 1 |
| | TZA | Transfer Zero to A Register | 1 |
| | TZB | Transfer Zero to B Register | 1 |
| | TZX | Transfer Zero to X Register | 1 |
| | AOFA | Add OF to A Register | 1 |
| | AOFB | Add OF to B Register | 1 |
| | AOFX | Add OF to X Register | 1 |
| | SOFA | Subtract OF from A Register | 1 |
| | SOFB | Subtract OF from B Register | 1 |
| | SOFX | Subtract OF from X Register | 1 |
| | SOF | Set Overflow | 1 |
| | ROF | Reset Overflow | 1 |
| Logical Shift | LSRA | Logical Shift Right AR k places | 1 + .25 k |
| | LRLA | Logical Rotate Left AR k places | 1 + .25 k |
| | LSRB | Logical Shift Right BR k places | 1 + .25 k |
| | LRLB | Logical Rotate Left BR k places | 1 + .25 k |
| | LLSR | Long Logical Shift Right k places | 1 + .25 k |
| | LLRL | Long Logical Rotate Left k places | 1 + .25 k |
| Arith-metic Shift | ASRA | Arithmetic Shift Right AR k places | 1 + .25 k |
| | ASRB | Arithmetic Shift Right BR k places | 1 + .25 k |
| | ASLA | Arithmetic Shift Left AR k places | 1 + .25 k |
| | ASLB | Arithmetic Shift Left BR k places | 1 + .25 k |
| | LASR | Long Arithmetic Shift Right k places | 1 + .25 k |
| | LASL | Long Arithmetic Shift Left k places | 1 + .25 k |
| Control | HLT | Halt | 1 |
| | NOT | No Operation | 1 |

*Denotes optional instruction. Add 1 cycle for each level of indirect addressing.

# VARIAN 620/L SPECIFICATIONS




**Type**
A system computer, general-purpose, digital, designed for on-line data system requirements.

**Memory**
Magnetic core, 16 bits, 1.8 microseconds full cycle, 750 nanoseconds access time, 4096 words minimum expandable to 32,768 words.

**Arithmetic**
Parallel, binary, fixed point, 2's complement.

**Word Length**
16 bits.

**Speed (Fetch & Execute)**

| | |
|---|---|
| Add or Subtract | 3.6 microseconds |
| Multiply (optional) | 18.0 microseconds |
| Divide (optional) | 18.0 to 25 microseconds |
| Register Change | 1.8 microseconds |
| I/O from A or B Registers | 3.6 microseconds |
| I/O from Memory | 5.4 microseconds |

**Registers**
Operation Registers — 4
Buffer Registers — 5

**Addressing Modes**
Direct, to 2048 words
Relative to P Register, to 512 words
Index with X or B Register (does not add to execution time)
Multi-level indirect
Immediate
Extended (optional)

**Instruction Types**
Single word
Double word
Generic
Micro-command

**Instructions**
Over 100 standard commands, plus more than 128 macro-instructions:

**Mainframe Logic and Signals**
Integrated circuit, 8.8 MHz clock, logic levels 0 V false, +5 V true. External logic levels 0 V false, +5 V true.

**Console**
Display and data entry switches for all operational registers; 3 sense switches; instruction repeat; single step; run; power on, off, and key lock.

**Input/Output**
Party Line Programmed Data Transfer
Single word to/from memory
Single word to/from A and B Registers
External control lines
External sense lines

Automatic Data Transfer
Direct memory access facility with transfer rates over 200,000 words per second.

**Computer Options**
Priority Interrupts
Group enable/disable, individually arm/disarm, single-instruction, multi-level priority interrupt system.

Real-Time Clock
Selectable time base.

Power Failure/Restart
Interrupts on power failure and automatically restarts on power recovery.

Memory Protect
Protects a top-priority executive, alarm, or monitor system resident in memory.

Buffered Interlace Controller
Permits automatic block transfer.

Buffered I/O Controller
A programmable, buffered hardware interface for general-purpose data processing.

Multiply/Divide and Extended Addressing
Hardware options for faster, more efficient programs.

# SALES OFFICES

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varian data machines
The Big Company in Small Computers

news letter

VOLUME 3, NO. 2 MARCH/APRIL, 1971

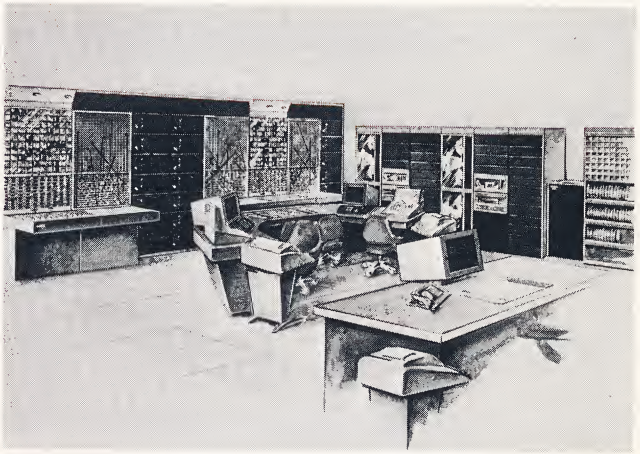
**Super Cop**

Bank thieves and burglars in the New York area had better beware. A Varian 620/f computer, ever alert, is on guard.

The computer-controlled protection system is the product of Holmes Protection, Inc. Six central control stations are now being installed, each with its own Varian 620/f computer. The total network will be protecting more than a thousand bank branches and monitoring over 14,000 factories, homes and retail stores.

Both fire and burglar alarm systems are included in the network. The computer continuously monitors the 27,000 input lines and starts action sequences whenever an incorrect signal is received. First step may be to wait 30 seconds for a cancelling signal from the alarm source. A store proprietor, for example, may be just opening his doors for the day's business; he immediately sends a secret code that tells the computer that all is well. Cancellation signals are accepted only during specific time periods on specific days.

The cancellation signal is compared to the correct code in the computer memory; if they correlate, the computer records the events that have occurred, but takes no further action.

*Central control station for protection alarm system.*

If the signals do not match, however, or if the 30-second interval elapses without the receipt of a signal, the computer immediately activates both audio and visual alarms in the central station. Dispatchers respond to the alert and send special guards or city police to the scene.

A special response scheme is used for banks and other customers who might be forced at gunpoint to send in a cancellation signal.

The underworld is generally aware of the detailed workings of an alarm system, but there is no reasonable way that the criminal can learn the "combination" code that applies to a specific bank or store. The manager can appear to be sending in a legitimate cancellation signal, while in actual fact he is notifying the Varian 620/f that he is in need of immediate help.

The main prerequisite for a system of this type is that it operate continuously, twenty-four hours a day, without error or breakdown. The Varian 620/f was selected almost entirely on the basis of its record performance. It is a new computer, with a fast 750-nanosecond cycle speed. But it has the heritage of the earlier Varian 620 models, which have proved to be among the most dependable computers of their type in the world.

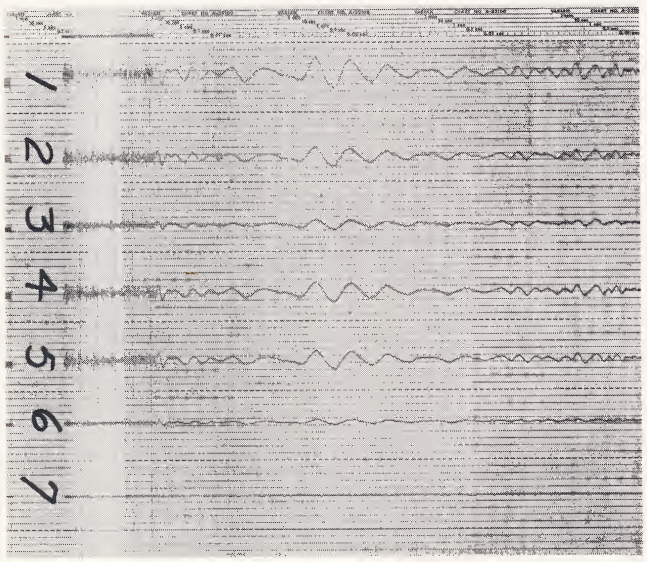
Because the Varian 620/f could be counted on to be both fast and faithful, Holmes has placed an order for over one million dollars worth of Varian computer equipment. Considering that the systems will be protecting hundreds of billions of dollars of property over the coming years, it is a worthwhile investment by any measure.

**Time Compressor**

The Varian Statos III is nominally a stripchart recorder. But engineers at the Baylor Company, Houston, Texas, are finding that it can do far more than simply record the data generated by Baylor for its petroleum-industry clients. The Statos III can also serve as a time compressor, time expander, and analytical tool.

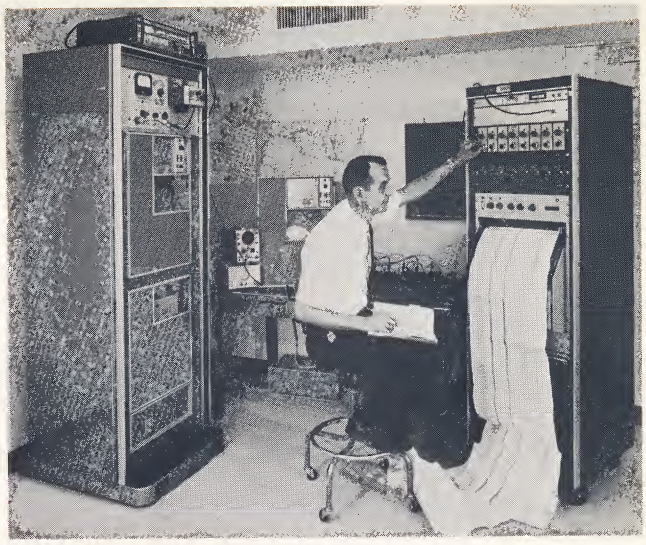
One of Baylor's specialties is the instrumentation of offshore drilling rigs. Magnetic tape recorders keep track of such environmental factors as wave action, tides, and wind velocity and direction. These are correlated with the stresses experienced by the structural members of the drilling rig.

The month-long records are flown to Houston, and by taking advantage of the variable data-recording speed of the Statos III, Baylor engineers are able to condense the information onto a manageable few feet of chart paper.




On the other hand, if a close analysis of a particular time interval is required, the record can be expanded into a long chart that shows the exact details of the events that have occurred. Since the Statos III is an 8-channel recorder, the data from the various sensing elements on the rig is presented in parallel and can be visually correlated by the engineer making the study.

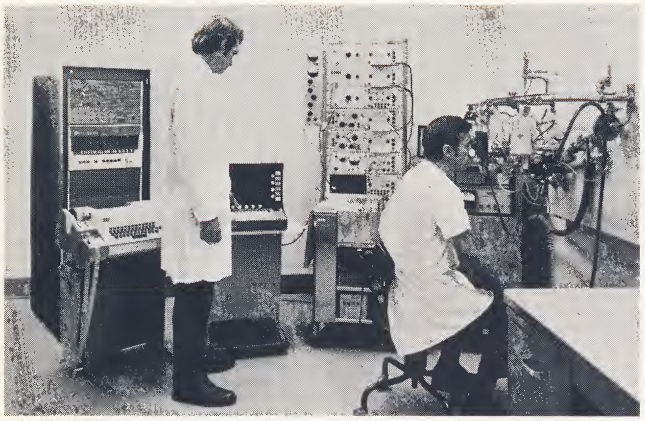
The multi-channel capability of the recorder also makes it possible to perform a portion of the analysis at the same time that the data is being recorded. The chart on this page, for instance, was produced from data generated by four strain gages mounted on a subsea tubular member. The first four channels were recorded directly from the individual strain-gage readings. Gages 1 and 3 were diametrically opposed in the vertical plane; their difference was therefore a measure of the horizontal bending moment. The Statos III circuitry subtracted one signal from the other and recorded the result in channel six. Similarly, gages 2 and 4 were diametrically opposed in the horizontal plane; their



difference was computed by the recorder and presented in channel seven as the vertical bending moment. Meanwhile, the Statos III was averaging all four of the original signals and recording the result in channel five as the total stress within the steel member.

The Statos III is an electrostatic recorder, with no moving parts other than the paper-handling mechanism. The paper moves under an array of 1,400 needle-like styli that are charged and discharged under digital control. A momentarily charged stylus produces an electrostatic charge in the paper. The charged areas attract and hold a dark toner powder. All other areas remain white.

Built-in analog-to-digital converters translate the magnetic-tape records into digital values for recording. Calculations such as those described above can therefore be performed in the error-free digital domain. Baylor engineers are looking forward to the day when many of their instruments will be producing direct digital data. The Statos III can accept both types of information interchangeably, producing a single record for analysis and study.



**Huff and Puff**

The simple act of breathing is not necessarily simple. Breathing is an essential life function, involving complex chemical and gas-flow interactions. It is the single most important interface between man and his environment.

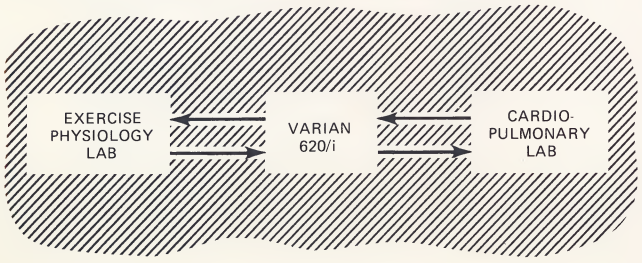
To the doctor, physiologist, and biomedical researcher, breathing is a unique "window" on the inner workings of the body. But, it is time-consuming to extract meaningful information about breathing from the mass of raw data available from respiratory instrumentation. In the past, this has meant the recording of a variety of measurements of physiological responses, followed by lengthy computations.

To simplify present procedures and make new test procedures possible, Varian's MD Systems Group has developed a series of hardware/software packages designed specifically for pulmonary studies. These systems, known as the PM (Physiological Measurement) Systems, utilize the Varian 620 series computer.

The first installation of the new equipment is at the Harbor General Hospital in Torrance, California. Harbor General is affiliated with the University of California at Los Angeles, and is both a research and medical center.

The installation is actually two systems in one, with a single Varian 620/i computer time-shared between two test laboratories. The systems may also be purchased individually. One of the laboratories is used primarily for research on the effect of exercise on the physiology of the body. The other laboratory is devoted to the clinical analysis of patients entering the hospital.

In the exercise laboratory, a research subject is outfitted with electrocardiogram leads, then seated on a bicycle-type ergometer. He exercises for 10-30 minutes at varying work levels, while breathing through a special gas-flow system.

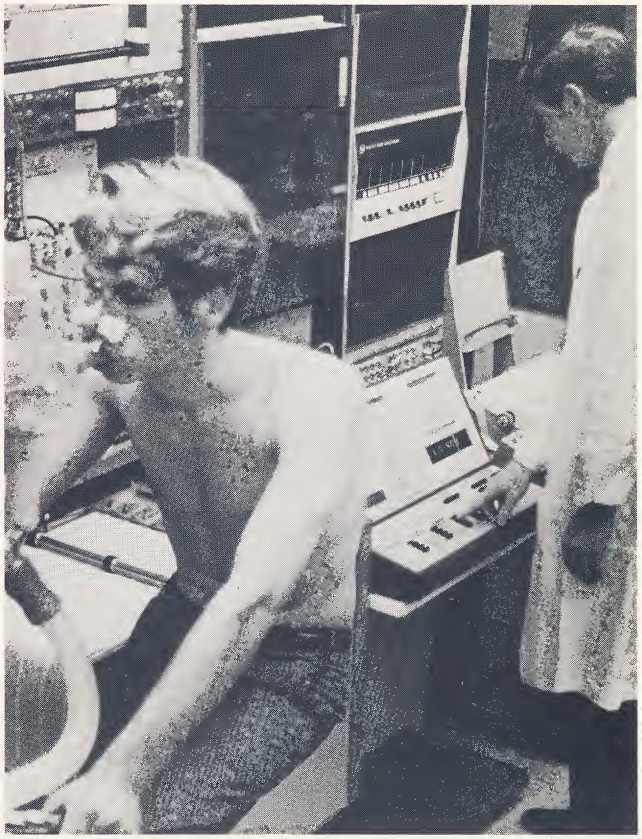



The PM System monitors his heart beat, correllating this with the flow rate, carbon dioxide and oxygen contents of both inspired and expired breaths. From this comparatively limited amount of input data, the computer system calculates, stores and plots such items as the respiratory quotient, oxygen pulse, carbon dioxide production rate, oxygen consumption rate, tidal volume, ventilation rate, respiratory frequency and breath interval, all on a breath-by-breath basis.

The program for the pulmonary function laboratory, by contrast, is more diagnostic in nature, assisting in the performance of routine analysis for nature and extent of pulmonary diseases. Up to 25% of all adult patients at Harbor General are suffering from some form of respiratory disease. Emphysema alone has increased 20-fold since 1950. The system enables the laboratory to keep up with the increased volume of work. The laboratory is also used for presurgical screening to determine whether a patient will be prone to pulmonary complications during anesthesia or after surgery.

The pulmonary tests measure such variables as the vital capacity, expiratory reserve volume, functional residual capacity, maximum inspiratory flow rates, and carbon dioxide partial pressures.

The output of the system is a specially formatted report for the attending physician, with a numerical indication of the patient's rating in each of the categories. This system will handle 3-4 times as many patients with no increase in attending personnel, provide increased accuracy and reduce the risk of spread of infectious diseases.



**Eagle Eye**

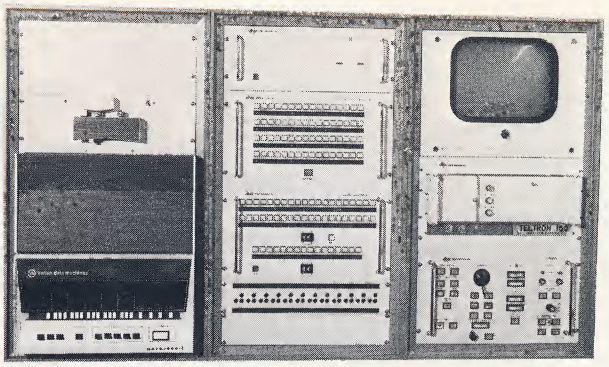
The combination of a high performance video error sensor and a Varian 620/i computer has proved to be an effective answer to a major missile-range problem: how to keep optical tracking instruments "on target" during the fast-accelerating, early minutes of launch.

The Optical Sensor and Tracking (OSAT) system keeps an eagle eye on the vehicle by monitoring the electronic image generated by the video error sensor. The OSAT system uses this information to generate, in turn, all the control signals necessary to keep the optical instruments on target. Even if the vehicle is momentarily lost, behind a cloud for example, the computer calculates its probable path and "coasts" the instrument towards the spot where the missile is likely to reappear.

The system has two target-acquisition modes. During the first few minutes of launch, the video error sensor looks for the white rocket plume, which is generally set against a contrasting background of buildings, mountains, and sky. Then, as the missile clears the horizon, the computer positions another tracking gate to look ahead of the plume and pick out the dark body of the missile.

In both cases, there may be distracting objects that could be easily confused as the target. To solve this problem, engineers at DBA Systems, Inc., Melbourne, Florida, divided the television image into a 20 x 20 matrix. Each of the 400 matrix segments can be selectively inhibited. The computer is instructed to ignore any target-like images that it might sense in the inhibited segments.

The TV camera that forms part of the video error sensing system scans the launch area once every 5.5 milliseconds. Two hundred TV lines are included in the field that is being monitored, and each is individually examined by the system. A target image is not validated, however, unless it appears on two consecutive lines. A further requirement is that the target appear in ten consecutive scans, or for a minimum period of 55 milliseconds.

One reason for this delay is to give the computer the data necessary to calculate the velocity and direction of the target. A dove prism in front of the camera is rotated under computer control so that the target path and image orientation appear perpendicular to the video scan. The computer continuously calculates the velocity and direction so that it can give "coast" directions to the optical instrumentation, should the target be momentarily lost from view.

With a valid target in sight, the system generates control signals for the optical tracking instruments at the same 5.5 millisecond intervals as the TV scan. The frequency of these commands means that even in the case of a fast-moving target, a smooth, precise optical record is achieved.

Present missiles and test vehicles barely tax the capabilities of OSAT. As newer, higher-performance vehicles reach the test range, the eagle-eyed system, controlled by the Varian 620/i computer, will be waiting and watching.

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